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of ADELAIDE

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8 May 2020

South Australian Productivity Commission Inquiry into Health and Medical Research in South Australia – submission from the University of Adelaide

On behalf of the University of Adelaide, please find attached a detailed submission in response to the March 2020 SAPC Health and Medical Research Inquiry Issues Paper.

As a major partner in the South Australian Health and Biomedical Precinct, the University is eager to participate in this initiative to identify opportunities to improve the State's capability to attract investment in Health and Medical Research.

Yours sincerely

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Deputy Vice-Chancellor and Vice-President (Research)

Attachment: University of Adelaide submission to the SAPC Inquiry into Health and Medical Research in South Australia.

South Australian Productivity Commission Inquiry into Health and Medical Research in South Australia

Submission from the University of Adelaide, 8 May 2020

This submission is presented on behalf of the University of Adelaide by Professor Anton Middelberg, Deputy Vice-Chancellor and Vice-President (Research). It is structured around the Inquiry terms of reference. Attention is also drawn to a separate submission made by the University's Faculty of Health and Medical Sciences which addresses many of the information requests contained in the Inquiry Issues document.

INTRODUCTION

At the highest level, the University is guided by its Strategic Plan, [Future Making](#), which states that the Vision and Mission of the University is to:

realise its purpose as a catalyst of knowledge creation and innovation, as an engine of social advancement, and as an active participant in the local, national and global economy.

The University of Adelaide has a long and distinguished reputation for sustained quality in health and medical research and its translation. As a research-intensive university with a long tradition of delivering innovative research outcomes in a local, national and international collaborative manner, the University of Adelaide is supportive of the innovation agenda, expanding research ties with industry and working closely with different tiers of government to deliver outcomes of benefit for the community. In fact, one of the University's significant strengths has been its strong partnerships with the local health sector, and a positive engagement with affiliates and clinical staff including titleholders.

The University of Adelaide is a major partner in the South Australian Health and Biomedical Precinct, which includes the Royal Adelaide Hospital, the South Australian Health and Medical Research Institute (SAHMRI), the University's Adelaide Health and Medical Sciences Building, and forthcoming University of South Australia's Health Innovation Building. This includes being a foundation partner in SAHMRI.

The broad areas of health and medical research currently within the University of Adelaide are:

- Cancer Biology and Clinical Oncology
- Cardiac, Respiratory and Vascular Health
- Fertility and Conception
- Pregnancy and Birth
- Early Origins of Health
- Child and Adolescent Health
- Neuroscience, Behaviour and Brain Health
- Surgical Health Systems and Innovation
- Indigenous Health and Health Equity
- Nutrition and Metabolic Health
- Oral Health
- Musculoskeletal Health
- Immunology and Infection
- Translational Health Outcomes
- Innovative Therapeutics
- Ageing, Frailty and Mobility
- Men's Health
- Genomics and Bioinformatics
- Synthetic Biology and Biotechnology
- Molecular Mechanisms of Disease.

Over the last decade the University has invested considerably in the South Australian health and medical ecosystem. For example, there is the Adelaide Health and Medical Sciences (AHMS) building. Completed in 2017 at a cost of \$246 million (of which \$60M was provided by the Federal Government), the AHMS is situated in the heart of Adelaide's BioMed City adjacent to the Royal Adelaide Hospital and SAHMRI. AHMS brings together more than 1700 students and 600 health researchers in a vibrant and innovative environment of learning and discovery and is home to the Adelaide Medical School, Adelaide Nursing School, Adelaide Dental School and Adelaide Dental Hospital, the School of Public Health and the state-of-the-art Adelaide Health Simulation.

The University has participated in collaborative initiatives (described in more detail below), most recently becoming a founding partner in the NCRIS-funded South Australian Genomics Centre. It has made several recent high-profile appointments in collaboration with SAHMRI, including Professor Mark Jenkinson from Oxford University and Dr Daniel Thomas from Stanford University (see below). The University has also made significant investment into SAHMRI and related initiatives (circa \$7M in 2019), as well as sharing many of our health and medical academic staff. The University currently has approximately 100 salaried staff and 130 Higher Degree by Research students providing critical mass to SAHMRI.

While we have experienced considerable challenges, and these are described in the following sections, the University remains foundational, intertwined and committed to the success of the State in increasing our impact and presence in this vital sector.

University of Adelaide Summary of Key Recommendations

1. Attract and retain high-quality research teams in South Australia through collaborative State investment in people, and a strong focus on specialised or niche Health and Medical Research (HMR) areas where the State can differentiate and excel.
2. Provide collaborative State investment in basic core research infrastructure, including the development of a long-term strategy and investment plan.
3. Re-integrate academic and clinical research endeavours for interdisciplinary HMR funding. This might include a competitive scheme to support protected research time for clinician researchers who are within the health system.
4. Expand and leverage clinical trials and confidential data management and analysis.
5. Improve visibility and future co-creation and co-branding of SAHMRI as a shared facility rather than a competitor, although noting the benefits of an independent MRI. This could similarly apply to developments such as SAHMRI 2 and the new Women's and Children's Hospital.
6. Create a clearer governance structure for the South Australian HMR ecosystem which avoids duplication, clarifies responsibilities, facilitates synergies and complementary capabilities, and assists with coordinated national funding initiatives.

Term of Reference 1: Assess the performance of health and medical R&D in South Australia, including a comparative analysis of South Australia's share of national grant funding benchmarked against other jurisdictions, with particular reference to how health and medical R&D in South Australia:

- Fosters innovation and improvement in health care service delivery that lead to improved health outcomes for the community and provide cost savings to the health system
- Encourages staff development that promotes high professional standards and supports recruitment and retention.

Please refer to the information provided under Recommendation 5.

Term of Reference 2: Identify and assess the key factors influencing the level of public sector (including universities) and private sector health and medical research output and activity in South Australia including:

- Talent and the capacity to attract new talent
- Industry structure and composition
- Funding, including Australian government funding
- Access to data: regulation affecting access to data; and efficiency of collection and acquisition
- Connectivity of the Biomedical Precinct and the planned Flinders precinct
- Potential for greater connectivity between the Local Health Network medical workforce and university recruitment
- Integration of research partners with SA Health.

Talent and the capacity to attract new talent

There is no doubt that one of the main keys to delivering successful and innovative research outcomes is centred on having great research teams, led by inspiring researchers, working in areas of significant value and stimulation.

In 2019, as a component of its new Strategic Plan, the University of Adelaide implemented a new scheme called 'Investing in Top Talent', a pro-active recruitment strategy to attract a cohort of new, high-performing researchers to South Australia with the aim of generating new or transformational capability. While the scheme is spread across the University, so far there have been three key appointees in the health and medical research area, made jointly with SAHMRI, with more to come:

- *Health Equity – Professor Alex Brown*
There is an imperative for better understanding health inequity in Australia where the ATSI population experiences much higher rates of mortality than non-ATSI cohorts. The Medical Research Futures Fund (MRFF) has explicitly identified ATSI Health as one of its highest priorities. The position is jointly funded by the University and SAHMRI.
- *Imaging and Neurodegeneration – Professor Mark Jenkinson*
Dementia represents a global health crisis with at least 44 million people estimated to be living with dementia. The development of methodologies for the analysis of structural MRI data has revolutionised the capacity to investigate the changes associated with neurodegeneration. New approaches to cognitive ability will add significantly to the areas of Frailty and Ageing and machine learning. Professor Jenkinson is jointly employed by the University of Adelaide and Oxford University, and the South Australian half of his position is jointly funded by the University and SAHMRI.
- *Cancer Clinical Trials – Dr Daniel Thomas*
There is a burgeoning of modalities in the treatment of common cancers, including immune checkpoint inhibitors and CAR-T approaches together with other developments such as proton beam therapy. Dr Thomas, formerly from Stanford University, will work closely with industry and pharma to recruit clinical trials to SA, leveraging SAHMRI's investment in the only proton therapy unit in the southern hemisphere. The position is a joint appointment between the University and SAHMRI.

It is also essential to support and attract researchers at the early and mid-career levels in order to build strong teams around the research leaders. Funding schemes and postdoc initiatives are critical to academic success, providing support and opportunities for researchers to collaborate and to develop the research capacity required to attract future funding.

Due to the highly competitive nature of world-class research, South Australia is often at a disadvantage in retaining and attracting new and innovative researchers due to a lack of critical mass, a lack of capacity to invest collaboratively in people and infrastructure (new buildings notwithstanding), and a lack of niche research areas having demonstrated leadership. It is worth noting that both Professor Jenkinson and Dr Thomas were originally from South Australia and were attracted back home rather than to South Australia itself as a new location.

Funding, including Australian government funding

It should be noted that the NHMRC has introduced major changes in its schemes and approach to provision of funding, commencing with limiting new project applications to two per Chief Investigator in 2018 (a disincentive to collaboration), and the introduction of new schemes in 2019. However, the expansion of the Medical Research Fund (MRFF) has provided a new, if at times less transparent, way to fund research. The latter also requires a far greater focus on interdisciplinarity for success, e.g. combining more traditional medicine with machine learning, advanced manufacturing, and health optimisation strategies. If the University of Adelaide and the State do not adapt to the requirements of the new funding regimes, and diversify sources of funding, we will fall even further behind the rest of the country.

In the era of the 'Investigator Grant', research institutions and states (especially small states) need to be able to work together in way that optimises synergies, but allows focus on what it is they do which is excellent, specialised or niche, rather than broad-based. South Australia tends to have a history of all core health and medical institutions attempting to be broadly comprehensive and broadly competitive across the major thematic areas. While there have been some excellent exceptions, South Australia has been unable to attract significant, 'super-star' research teams to the State. The development of the SAHMRI thematic structure perhaps took SA part-way towards a foundation for future recruitment and development, but it was not deep enough or inclusive enough and lacked the necessary investment to succeed. Recruitment should be at the highest international standard and include sufficient funding to support the work of these teams once here. This could be done in partnership with SA Health and possibly the health networks, and in key areas of excellence if resourced.

It is important to note that continuing Federal Government support to address the increasing indirect costs of research is critical if South Australia seeks to host a vibrant research system which is internationally competitive and economically viable.

Philanthropy has long been an important component of support for medical research. For example, the Walter and Eliza Hall Institute of Medical Research, probably the most successful MRI in Australia, was founded in 1915 by an endowment. To what extent can South Australia seek additional philanthropic funding to support its ambitions? The Hospital Research Foundation has been one of the most successful initiatives, but it would be worthwhile assessing how well it is aligned with institutional and collective State ambitions in health and medical R&D.

In considering funding performance, it is important to recognise the importance of all research income types whether competitive or non-competitive, public or industry-funded. Due to past funding models and peer review selection processes, Category 1 (nationally competitive) research schemes continue to be correctly perceived as the most prestigious for reputation building, which has not helped institutional attempts to diversify income streams, even though the various sources of income are not mutually exclusive.

Precincts

One of the difficulties in any large-scale collaborative venture can be maintaining balance in operational cost-effectiveness versus ease of access to required infrastructure and services. Co-investment from partners in building and maintaining a collaborative site is desirable and valued, but can present management challenges and potentially lead to conflicts around 'ownership'.

While there have been strong efforts to promote the (North Terrace-focussed) biomedical precinct with its very impressive buildings, including the University's own Adelaide Health and Medical Sciences building, it must be said that the precinct has yet to deliver as an interconnected and collaborative initiative. There are overlapping jurisdictions, unnecessary duplication of existing capabilities, misaligned partner aims and strategies, siloed cultures, and a lack of overall awareness of the purpose of each component. In particular, the function, achievements and potential of Adelaide Biomed City remains somewhat elusive. There is also the need to take into account the important role played by Flinders University and the Northern and Southern Local Health Networks which do not reside on North Terrace, in terms of ecosystem totality.

As detailed in the Inquiry submission from the University's Faculty of Health and Medical Research, but worth reiterating, there was a well-functioning ecosystem in the eastern part of the city with the old

RAH, SA Pathology, the University of Adelaide and the University of SA, with close connections between university and clinical staff. The move to the western end of town, to relocate around the new RAH, caused a considerable disruption to that collaborative environment, and this has yet to be rebuilt in Adelaide BioMed City.

Connectivity between the Local Health Network medical workforce and university recruitment

The University of Adelaide has close connections to the LHN Network, particularly Central Adelaide Local Health Network (CALHN) and the Women's and Children's Health Network (WCHN), and is developing a closer relationship with NAHLN, for example in the area of indigenous health equity.

One notable example is the strong connection between the WCHN and the University's Robinson Research Institute (RRI), one of the flagships of our research strength. The RRI is a collective of internationally-renowned researchers in human reproduction, pregnancy and child health at the University of Adelaide, led by Professor Sarah Robertson. It focuses on the early stages of life to improve the health and well-being of children and families over the life course and across generations, in Australia and around the world. Research is grouped within four themes:

- Fertility and Conception
- Pregnancy and Birth
- Early Origins of Health
- Child and Adolescent Health.

The Institute's Research Leaders head up 42 research groups, providing significant collaboration across its 350+ members. The RRI also has a number of Clinical Partner members working across hospitals and clinics in South Australia who collaborate with researchers on research projects and trials.

In addition, joint appointments should be fostered and the mutual benefits clearly articulated and managed. One such recent and successful arrangement is that of Professor Andrew Zannettino, Pro Vice-Chancellor (Health Partnerships) at the University of Adelaide, who also supports CALHN as the Executive Director of Research Strategy.

It is also worth noting that for the last 20 years the University has accepted Human Ethics approvals from the teaching hospitals. In terms of Animal Ethics, a few years ago the University adopted mutual recognition of approvals across the Health Services, SAHMRI and other SA universities, which has been effective in reducing the number of applications that researchers need to submit.

Clinicians are (rightly) primarily driven by saving and improving the quality of lives and not just by research publications, so there are different drivers across the hospital and university systems. From a health network perspective, it is essential that their medical staff provide adequate clinical service for the taxpayer dollar. The University receives considerable benefit and impact from its titleholders and clinical staff and believes that the clinical interface can work both ways. While accepting the need for SA hospitals to deliver high-quality services, we believe clinicians should be provided with the opportunity to engage in research activities where feasible. They are most valuable as members of team-based applications where they can contribute to translation and impact, complementing the more fundamental research of university academics. This requires a strong collaborative ethos and an environment of mutual trust across the clinical and academic cultures.

A research culture within a health network environment provides several tangible and intangible benefits. A research-enabled network/hospital will attract the best workforce, adopt evidence-based protocols of care and save system resources by providing the appropriate level of care in a cost-efficient manner. South Australia has a history of supporting clinician researchers, with many of their innovations adopted internationally (e.g. peripheral blood stem cell transplants, mesenchymal stem cell therapy, islet cell transplantation, IVF, etc.). Further, historically, the health networks provided resources, in the form of funding and hospital scientists, who would assist clinical academics to conduct their research.

One way to reduce the perceived barriers would be to ensure fair and equitable sharing of benefits with associated clear Intellectual Property arrangements for potential commercial projects across organisations. For a significant proportion of 'public good' research, formal agreements at the institution-to-institution level that promote sharing of background IP might be considered. Either way,

clear and more consistent IP policies are needed in the State, particularly as the number of joint appointments and affiliated appointments continue to rise. This creates a minefield of complex arrangements for researchers including clinicians that are not consistent from project to project over time, let alone across institutions, and this could be an impediment to future growth.

The MD to PhD pipeline is another avenue worth exploration. This was a useful pipeline in the past but has become more difficult within current structures. The University of Toronto provides a good example of such a [program](#) where:

Physician scientists are trained as medical doctors and scientists. They are in the unique position of pursuing both scientific research and clinical practice, translating academic excellence into health care excellence for Canadians every day.

A particularly important point is that research must be valued within SA Health and clinicians need to be encouraged and supported to undertake it.

The current situation might be improved by a competitive scheme to support protected research time for clinician researchers who are within the health system. This could allow the growth of the clinical research base and help to attract senior research-active clinicians into the SA health system, ultimately reinforcing the capacity to translate outcomes into practice. Research positions need to be embedded in core operations in the health system, but with connection to the University.

Such an initiative would also be greatly facilitated by increased clinical trials capability in SA, which provides an ideal environment for recruitment and retention of participants. The universities need to work with the local health networks (e.g. CALHN, NALHN, WCHN), and in association with SA Health and Health Translation SA to promote this.

<p>Term of Reference 3: Identify and assess existing collaboration on health and medical research between research organisations (public and private) and linkages between organisations and industry. Identify collaboration models to drive R&D.</p>

There is no doubt that there are some good examples of research collaboration within the State.

For example, the University of Adelaide has several joint appointments with SAHMRI (a number of whom lead SAHMRI Themes), including Professor Maria Makrides, Professor Deborah White, Professor Tim Hughes, Dr Louise O'Keefe, and more recently (as listed under Term of Reference 2) Professor Alex Brown, Dr Dan Thomas and Professor Mark Jenkinson. We also have strong associations with the SA public hospitals and SA Pathology in areas including cancer biology, virology, bioinformatics, childhood dementia and, more recently, COVID-19 research.

Shared infrastructure is another essential part of collaboration for mutual benefit, and the following examples provide useful models.

Adelaide Microscopy is an NCRIS-funded, multi-user facility that provides microscopy and microanalysis services to students and staff of the University of Adelaide, other universities and industry. These services are strategically important to the University's research performance in areas including biological sciences, nano-technology, geology, mining, materials engineering, chemistry, health (e.g. bone imaging) and dentistry. The quality of the centre provides Adelaide with a significant competitive advantage in generating high-quality publications, attracting new research grant income, and reducing the need for expensive outsourcing by our researchers. One of the essential components in innovation, is having appropriate infrastructure to conduct cutting-edge research and development. This can be very expensive but may yield significant long-term benefits. One outstanding example is the South Australian Regional Facility for Microscopy and Microanalysis. Launched in 2008, the Facility is an alliance of laboratories at the three South Australian universities and the State Government, and part of a national joint venture (the Australian Microscopy and Microanalysis Research Facility).

In this area, the University acknowledges the valuable investment by the State Government in the core NCRIS-supported facilities in South Australia.

A much more recent example for shared enabling facilities (an area of considerable potential) is the new South Australian Genomics Centre, due to open on 1 July 2020; a consortium led by Bioplatforms Australia Pty Ltd and involving SAHMRI, the SA universities and other partners. The consolidation of bioinformatics support in SAGC is a strong, mutually-beneficial initiative with considerable value to the University and South Australia more widely. It was created in response to the growing scale of research utilising bioinformatics, with the aim of creating new engagement opportunities between researchers and facilitating further integration between genomics user groups and bioinformatics experts.

An example where there is potential for greater collaboration is Health Translation SA, the aim of which is 'to enable research findings to be translated into action, as quickly as possible and in a practical way, to ensure that health research can positively impact on the health of individuals and the community'. Unfortunately, it appears to have minimal recognition within the health and medical research community, at least at the University of Adelaide. As it can play a significant role in facilitating the connection of research to clinical work, it needs to be better promoted by the State Government.

Term of Reference 4: Identify and assess opportunities for increased commercialisation of health and medical research in South Australia.
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The University of Adelaide, through its commercial development arm and with limited resources, has assisted with the establishment of a number of start-up companies, including the following:

- GPN Vaccines is developing an effective vaccine that protects against all *Streptococcus pneumoniae* strains, regardless of strain serotype. The best vaccine currently on the market only protects against 13 of 98 serotypes. Gamma-PNTM – GPN Vaccines' new *S. pneumoniae* vaccine is being developed to protect children and adults against all *S. pneumoniae* strains, regardless of strain serotype.
- Trajan Nutrition has a goal to improve the health of mothers and their children by providing accurate and unbiased information that can be used to develop a personalised dietary pathway to better health. It aims to help mothers develop a better understanding of the essential roles that good nutrition plays in setting the foundations for a healthy start to life.
- Carina Biotech is a biotech company researching and developing an effective broad-spectrum chimeric antigen receptor T cell (CAR-T) therapy to treat solid cancers.
- OncoDX: Using a combination of proprietary and known molecular markers associated with early stage ovarian cancer, OncoDx is developing an assay for detecting early stage ovarian cancer. The company is currently developing the test assay platform and validating it using patient blood and tissue samples.
- Miniprobos: An inexpensive handheld probe for 3D optical coherence tomography scanning. Configured for common-path OCT, they avoid the need for an interferometer by generating their own internal reference reflection.
- Chitogel: A postoperative hydrogel nasal dressing that can be applied to sinuses after endoscopic sinus surgery. The hydrogel is made by combining chitosan succinamide, dextran aldehyde, and, a sodium phosphate buffer solution. It reduces ostial stenosis, minimizes adhesions and acts as an adjunct to aid in the natural healing process.

However, it must be noted that the commercialisation of new technologies from the health and medical sector can be a long and complicated process. It is well documented that the timeframe to go from 'bench to bedside', that is from the initial breakthrough in a research laboratory to a new therapeutic being approved by regulators and available to the health care system can take between 10 to 15 years. There are also many reports highlighting the average cost of developing and launching new therapeutics to exceed an investment of well over US\$800M – some reports put this cost at over US\$1B.

If we take this from the 'bench' starting point, funding support is typically led by national competitive grants schemes such as the NHMRC and MRFF. There is also a strong level of support from various charities and not-for-profit organisations across the State and the nation. This work will often yield interesting research outcomes that could have utility as new diagnostics, therapeutics or medical devices. The reality is that initial funding will enable research leaders to achieve 'proof of concept' or demonstration that, in *in-vitro* or rodent animal models, the new discovery has clinical potential.

The challenge is funding the next step which is to demonstrate the efficacy of the new discovery in large animal models or first in human clinical trials. From a technology development perspective achieving this de-risks the new discovery enormously. However, this is also the point at which many new discoveries will fail where they cannot be scaled-up in manufacture and/or they fail to demonstrate efficacy as expected. This is often referred to as one of the 'valleys of death' in commercialisation. Funding for this is extremely limited in Australia as this work does not look to make new discoveries and it is also not taking a new product to market. Venture investors are reluctant to fund this work due to the failure rate and, as such, the market does not always support it.

In the past, the SA Government supported Bio Innovation SA as a dedicated granting body for health and medical research commercialisation. The funding that this organisation administered was specifically targeted at this first 'Valley of Death' with the aim of supporting new technologies from SA to be investor ready, that is developed to the point where Venture Capital funds would be able to invest in new start-up companies to take these technologies to market.

Whilst Bio Innovation SA supported many technologies and new companies in SA, much has happened over the years and grant support from the State Government is now supported through the Research Commercialisation Start-up Fund. It is a credit to the SA Government that these funds are made available. Unfortunately, it is a relatively small sum of money that is promoted to support technology opportunities from across all sectors and not just the health and medical sector, further 'diluting' the scale of funds available.

Universities also have proof-of-concept funds committed and budgets to fund Intellectual Property protection. In the highly competitive higher education sector, these funds are extremely difficult to defend and are themselves limited in scale and expected to support technologies developed from all research areas of the university. Particularly in the face of COVID-related revenue pressure.

Overall, what is lacking is funding at scale to support more new research breakthroughs in the health and medical sector of SA, to get further down the development path to definitive clinical efficacy. Access to such funding would see more new research breakthroughs, developed locally, reach the point of further investment by companies and/or investors to commercialise these outcomes and deliver new products to market.

The next element to support greater success in this endeavour is closer links between fundamental research at universities and clinical needs in hospitals (as detailed under Term of Reference 2). However, as mentioned previously, within the wider Health and Medical Precinct, there continues to be a disconnect where these activities are not linked as effectively as they could be to leverage the expertise and capability of each individual group to drive outcomes in clinical translation and have significant impact on patients and our community.

<p>Term of Reference 5: Identify and assess measures of productivity and impact of research activity (including by key areas of research), South Australia's share of national funding programs such as the Medical Research Future Fund, and the performance of publicly funded research institutions in South Australia compared to other jurisdictions, including overseas.</p>

As rightly noted in the SAPC Inquiry Issues Paper (p.12):

South Australia is falling behind in its ability to attract funding for health and medical research.... This is despite the state improving its performance relative to the Australian average in other areas, including medical exports and growth in the number of clinical trials.

While there are numerous sources of competitive funding, the National Health and Medical Research Council (NHMRC) has traditionally been the major source of national research funding for health and medical research in Australia. The 2019 outcomes for competitive grants provide a useful snapshot of the relatively poor performance for South Australian institutions in achieving a share of this national pool.

NHMRC 2019 outcomes by Administering Institution for competitive grants – SA institutions

Administering Institution	Funded	Amount
University of Adelaide	20	\$21,311,495
Flinders University	14	\$14,634,905
University of South Australia	14	\$13,500,023
SA Health and Medical Research Institute	2	\$1,625,750
National Total	768	\$884,303,506

Source: Summary of the results of the NHMRC 2019 Grant Application Round - <https://www.nhmrc.gov.au/funding/data-research/outcomes-funding-rounds>

While the quality of its research, particularly as represented by academic publications and citations relative to world benchmarks, remains high, as demonstrated in the 2018 Excellence for Research in Australia report with a ranking of '5' (well above world-standard) in 11 health and medical fields of research¹, the University of Adelaide recognises that its performance in attracting competitive health and medical research income funding has declined in recent years. It should be noted that there are many ERA '5' outcomes in health and medical fields across the country, and that this does not automatically lead to research income. As the following table shows, over the period 2014-2018, national reported NHMRC Category 1 income has grown by 5.4% while the University of Adelaide's NHMRC income declined by 12.5%.

Category 1 income – NHMRC – 2014-2018

Institution	2014	2015	2016	2017	2018
Adelaide	\$30,320,650	\$28,566,728	\$27,720,945	\$23,310,800	\$26,538,737
Total National Funding	\$636,777,026	\$628,399,732	\$615,157,112	\$619,721,429	\$670,938,546

In this context, over this same period, national health and medical research funding, at least in terms of the NHMRC, has been increasingly constrained. Nevertheless, other universities, medical research institutes and states have achieved some growth and increased national share, resulting in an increased concentration of research activity elsewhere, mainly on the eastern seaboard. This at least partly related to having significantly increased their level of research investment and development of strategies to drive success, and South Australia and the University of Adelaide have not kept pace. Consequently, the critical mass and momentum in health and medical research has been moving away from South Australia generally.

For example, the University of Adelaide has experienced a significant decline in the number of academic staff working in health and medical research over the past five years, and this has been more noticeable in the early and mid-career levels. It is also worth noting that many of our current grant winners have been with the University for many years. This is not to detract from their value or ability, as a solid number of outstanding individuals have cultivated highly-productive Adelaide-based teams, but points to the difficulty of attracting new people to the University and the State. We haven't imported success and have often simply moved people between local institutions which has contributed to limited growth for SA as a whole.

¹ Cardiovascular Medicine and Haematology, Clinical Sciences, Dentistry, Medical Microbiology, Neurosciences Nursing, Nutrition and Dietetics, Oncology and Carcinogenesis, Paediatrics and Reproductive Medicine, Pharmacology and Pharmaceutical Sciences, and Medical Physiology.

It should also be noted that the University and the State has so far underperformed in attracting a reasonable share of funding from the Medical Research Future Fund, even though we have a collaborative approach across the three universities.

Term of Reference 6: Identify and assess the characteristics of South Australia and its population that may give rise to areas of competitive advantage compared to other jurisdictions in health and medical R&D, and identify methods of maximising these opportunities.

The University of Adelaide has competitive strengths or advantages in the following areas:

- Reproductive Medicine and Paediatrics
- Cardiovascular Disease
- Metabolic Disease
- Cancer – solid tumours
- Cancer – leukemia, lymphoma, myeloma
- Health Technology Assessment
- Aboriginal Health Equity
- Infectious diseases
- Medicinal chemistry
- Innovative imaging tools.

The following provides some detail on just three of the above strengths.

Firstly, the University has a particular strength in early life determinants of health and well-being. This research begins at the earliest phases with reproductive medicine and continues into child and adolescent well-being. This strength is primarily expressed through the Robinson Research Institute with Professor Sarah Robertson leading work on immune regulation of fertility and pregnancy; Professor Jozef Gecz leading work on the neurogenetics of intellectual disability; Professor Jodie Dodd leading research on obesity in pregnancy; Professor Jenny Couper working in Type 1 diabetes; Professor Helen Marshall working in vaccines; and Professor John Lynch leading work on child health and development and disadvantage.

Secondly, the University conducts world-class translational research in pneumococcal disease, influenza and development of new vaccines to combat these diseases. This work is largely conducted by the Research Centre for Infectious Diseases (RCID) led by Professor James Paton, who is also co-founder of biotech spin-out company GPN Vaccines Pty. The RCID is also a platform for clinical research and clinical trials in virology.

Adelaide Health Technology Assessment (AHTA) is a unit of national strength and a point of difference. It undertakes evidence-based assessments of health interventions to inform policy and practice, working closely with health and medical researchers to provide advice on study design, data collection and management systems, and statistical analysis. AHTA attracts significant amounts of contract research funding, although a substantial proportion of these outputs are unable to be published due to confidentiality requirements. However, the impact of AHTA's contract research is considerable in terms of changing national health policy and providing access to cost-effective health interventions for the entire Australian population.

The decision to prioritise specific areas will always be related to a number of changing factors:

- social demand and need
- funding body priorities
- individual academic interest
- the need for critical mass
- competition from other institutions
- emerging opportunities.

An underutilised area which could well provide a competitive advantage relates to the scope for extensive data linkage activities across South Australia, particularly with the implementation of a universal electronic health record in the State, which could facilitate highly significant research focused on health outcomes. The University of Adelaide has considerable capability in this area and

could lead a South Australian program, in partnership with SA Health, other government and community stakeholders, as well as researchers from other SA institutions.

This could build on the data linkage agency SA NT DataLink, established in 2009 as a collaboration between the South Australia and Northern Territory partners to inform many areas of policy and service development. It could also leverage the University's Australian Institute for Machine Learning (AIML).

Researchers in AIML, such as Professor Mark Jenkinson mentioned earlier, are applying medical machine learning to the healthcare areas of cardiology, colorectal cancer screening, obstetrics and gynaecology, arthroscopy, public health, stroke, vascular dementia, and breast cancer screening. Among the success stories coming out of the Institute is LBT Innovations, an Adelaide-based company that is now producing an 'entirely new class of medical device' that is being sold in the US. The device enables sophisticated AI to be applied to data captured elsewhere, supporting pathology and delivering better patient outcomes.

Indigenous Health Equity is another important area for the State and beyond, with excellent work being conducted by Professor Alex Brown and his colleagues, and is an area that provides significant opportunities for growth.

One of the biggest challenges for the University and the State as a whole is attaining critical mass. We should be aiming for larger aggregations in priority areas, rather than the division into small units that often work across each other and which creates unnecessary complexity. As mentioned elsewhere, this is about the synergy between collaboration (where it makes sense for mutual benefit) and competition (to drive innovation and build international reputation).

One large initiative of note is the creation of the South Australian immunoGENomics Cancer Institute (SAiGENCI). As the Commission will be aware, the Commonwealth Government announced in August 2019 that it would invest \$80M in a world-class medical research institute in South Australia. The vision of the Institute is to cure cancer by using the latest genomic and immune-based technologies and it will catalyse the overall growth of research effort in cancer biology and the translation of research outcomes. This initiative is an excellent opportunity for the growth of health and medical research and fits well with some of the University's identified strengths.

Interdisciplinary opportunities

While a much wider issue that simply for South Australia, there is strong need to promote interdisciplinarity.

There are clear areas of synergy between biological sciences, chemistry and chemical engineering (e.g. with pharmaceutical and bioprocessing researchers who specialise in the conception, design and scale-up of manufacturing processes for the conversion of chemical and biological materials into pharmaceuticals and medical devices). Further interdisciplinary opportunities could centre on links between health and research in environment, water quality, animal health and nutrition as key aspects of human health. This in turn could inform policy on food and nutrition, zoonotic transition of diseases, and global issues associated with drought and famine.

The rise in non-communicable disease such as obesity and type 2 diabetes, much of which is driven by poor diet, is one of the key health challenges for developed countries in the 21st Century and, in some countries, life expectancy is now lower for children than their parents' generation due to diet-related disease. The agrifood sector, which is a key strength area for South Australia, has a role to play in addressing this issue. Improvements in diet and nutrition can be introduced at a number of points in the value chain. Examples that have already been shown to improve health outcomes include the breeding or biofortification of crops with lower GI and improved nutritional profiles, additions made to livestock diets that improve or lead to specific health benefits for consumers (e.g. Omega-3 enriched eggs), and the adjustment of food processing technologies for healthier food products (e.g. retention of fibre and phytochemicals). Such interventions will lead to better health outcomes for our aging population.

The Waite precinct, which includes the South Australian Research and Development Institute, as well as the bulk of the University of Adelaide's expertise in crop breeding, food science and horticulture,

has untapped potential as a key site for the development and identification of foods designed for better health outcomes.

Another burgeoning area for interdisciplinary opportunities lies in the incorporation of technology. For example, the University has two major Research Institutes (one of which, AIML, has been described above) and a Centre of Excellence working on health interfaces.

For example, researchers in the University's Institute for Photonics and Advanced Sensing are working on applied research projects including a 'Smart Needle' for safer and more effective brain surgery, and an optical fibre probe that distinguishes breast cancer tissue from normal tissue, while members of the ARC Centre for Excellence in Nanoscale Biophotonics are using the power of light to help understand the complex molecular processes that underpin the living body, as well as other dynamic biological systems, and driving the development of innovative new molecular sensing tools. Examples of similar work in other parts of the University include 'smart digital' computing solutions as a holistic concept to develop sensing technologies for use in Cardiovascular and Orthopaedics treatments; the potential for development of space medicine; and opportunities for cross-disciplinary training and education, particularly at the postgraduate coursework level, including micro-credentials, drawing on the University's expertise in, medical sensor signal processing, biomechanics, machine learning and data science for medicine.

Many of the real innovations globally are occurring at the intersection of health and technology, and we need clear incentives and business models to resource the interface between these areas.

Term of Reference 7: Identify industry needs and current barriers to undertaking health and medical R&D in South Australia and identify models to facilitate industry health and medical R&D in South Australia.

The input provided under Term of Reference 4 on commercialisation goes some way to addressing the issues surrounding industry engagement in this space. In this regard, it seems that there is a limited local health industry in South Australia that could be a partner to research opportunities, and a lack of focus in attracting them.

Term of Reference 8: Recommend action that the South Australian Government might take to:

- a. Increase the state's share of Australian Government funding for health and medical R&D
- b. increase the scale and productivity of publicly funded and public health and medical research institution R&D as well as private sector R&D.
- c. increase the impact of health and medical R&D activity in South Australia on the state's economic growth.

As detailed under Term of Reference 3, there are a number of positive examples of infrastructure collaboration within the State, and this is an area which should be expanded. In this respect, it is important not only to invest in infrastructure around the West End Biomedical Precinct and beyond, but also to create incentives to share infrastructure across institutions. The quality and breadth of baseline infrastructure in South Australia which is readily accessible and cost-effective is absolutely critical to building productivity and attracting new talent to the State. Many topflight researchers are attracted to the eastern seaboard institutions precisely because it is easier to undertake their research there, and they get better outcomes from access to cutting-edge technologies.

While the State Government has invested significant resources in the new Royal Adelaide Hospital, there has been an underinvestment in the health sector more generally. One particular requirement is to invest in more basic, shared, core infrastructure, something which is genuinely lacking at the moment. For example, State-based animal houses, biobanks, an uplift to SA Pathology and PC3 capability, NMR capability, data storage and High-Performance Computing, and health research equipment for which it is very difficult to attract competitive funding.

Unlike the Australian Research Council (ARC) with its Linkage, Infrastructure and Equipment Fund, the NHMRC offers only a smaller scale scheme specifically to fund equipment, based on prior year's funding rather than being competitively assessed. A review of the critical SA-based health and

medical infrastructure (and gaps) would be highly beneficial in prioritising future investment in SA, and will inform future strategy development and recruitment initiatives across the State. Shared access agreements have also been problematic in the past when individual institutions own specialised equipment and seek to restrict external access to maintain a competitive advantage. Similarly, some institutions have set the charges for external access at very high levels. These are all impediments to productivity. This is an area where the State Government could make a difference, by ensuring critical base infrastructure is housed in open access, well-managed facilities that are set up for cost recovery and provide a wide range of value-add services.

Consolidation, done in a strategic manner with support and input from the State's research institutions, would facilitate collaborative research that is affordable while maintaining and replacing equipment to retain access to up-to-date technologies. For example, SA has, at best, one PC3 laboratory which operates in SA Pathology. Setting up and maintaining such a facility is expensive and from a cost-benefit perspective is a stretch for any one institution. However, to build up a shared facility in a neutral site such as SA Pathology that is supported by all users would be enormously beneficial to the State – as demonstrated by recent events with COVID-19.

This would be complemented by a long-term investment strategy by SA Health (in a coordinating role) for the sector that was able to take account of the changing health and medical research ecosystem where the State is focussed on achieving pre-eminence in specialised or selected areas (as opposed to a broad-brush approach). It should also aim to simplify and clarify overlapping responsibilities for such infrastructure in SA. This long-term perspective would support the attraction and retention of talented researchers to the State.

Term of Reference 9: Recommend changes to the structure, governance and operation of publicly funded health and medical research and development to increase research output, productivity and translational impact.

It must be said that health and medical research in SA is complex, challenging, and has not yet settled into a mature ecosystem. There are numerous stakeholders in a relatively small State which has led to duplication of precious resources, multiple badging of research programs, confusion with staff over access to services, etc. This contributes to a failure within the State to release the full power of the relationship between the university sector, the public hospitals and medical research institutes. Of course, there are fine lines between legitimate and required competition, mutual collaboration and synergistic relationships.

It will be important for the Commission to examine examples of best practice from other parts of the country, including Melbourne, NSW and Queensland. The Doherty Institute in Victoria, a joint venture with the University of Melbourne, is a good example of a successful MRI-University collaboration that is different from the SAHMRI model in South Australia.

As the only Group of Eight university in the State, and with the largest medical school, the University of Adelaide seeks to be competitive nationally and internationally, collaborating where appropriate synergies exist. While cognisant of the need to balance our need to be competitively successful on the national and international stage as a leading research-intensive university with the need to work synergistically within the local community for the benefit of the State as a whole.

The challenges of the current ecosystem are exacerbated by the multitude and non-transparency of governance systems. For example, although the University is a member of SAHMRI and has a very good relationship with Executive Director, it does not have visibility over the latter's budget, even though it provides significant financial and in-kind resources, including a large number of staff. Notwithstanding the positive collaborative examples mentioned earlier in this submission, there are instances where the relationship has led to duplication, confusion with staff, and a non-alignment of models and incentives leading to unnecessary internal competition which provides no net gain to the State.

The Commission will be aware that there have been numerous reviews of health and medical research in SA and nationally over the last decade. For example:

- Venturous Australia: building strength in innovation, 2008 (the Cutler Review)
- Strategic Review of Health and Medical Research – Better Health through Research, 2013 (the McKeon Review)
- Review to Strengthen Independent Medical Research Institutes in Australia, 2015 (the Samuel Review)
- Review of Research Governance in the Department for Health and Wellbeing (SA), 2018 and related LHNs (the Birch Review).

One of the more significant of these was the 2008 Review of Health and Medical Research in South Australia (Shine Young Review) which led to the establishment of SAHMRI.

Due to the centrality of SAHMRI within the South Australian health and medical ecosystem, it is considered worthwhile to provide a significant section in this submission on the creation, development of SAHMRI and its relationship to the University of Adelaide.

South Australian Health and Medical Research Institute (SAHMRI)

In order to ensure South Australia's strong position in health and medical research in the future, in 2008 the SA Government commissioned a Review of Health and Medical Research in South Australia. The Review made three key recommendations:

- (a) establish an independent health and medical research institute;
- (b) house the institute in a new "flagship" research facility; and
- (c) build and maintain a health and medical research fund.

The Review was established in part in response to a need to address South Australia's declining share of nationally available research funding, primarily NHMRC funding. It was considered that research productivity in the State could be increased by leveraging the existing areas of excellence and building stronger collaborative partnerships. A shared and public vision of broad engagement between the three South Australian universities and SA Health was articulated.

SAHMRI was incorporated as a company limited by guarantee in December 2009 and opened in its current location on North Terrace in November 2013. SAHMRI's founding members are the South Australian Government, the University of Adelaide, the Flinders University of South Australia and the University of South Australia. As the key research organisation in the health and medical area in the State, the University of Adelaide was, and continues to be, the major stakeholder in SAHMRI.

SAHMRI is governed by a Board that includes representatives of South Australia's three universities and representatives from the State health sector. An outstanding Executive Director was recruited to South Australia from Monash University and provides excellent connectivity to the national independent MRI network.

It was recognised very early that the proposed SAHMRI model created potential risks for the University, some of which were subsequently realised:

- Realignment and repositioning of research groups as researchers transferred their employment, or their affiliation, to other institutions, with limited genuine growth occurring;
- The universities collectively were expected to provide significant support (and research staff) to SAHMRI, rather than it being genuinely additive;
- As the State budget experienced increasing demands, it was anticipated that it would be difficult for the State Government to directly support SAHMRI at levels comparable to the support provided to MRIs by State Governments interstate, potentially leaving the universities to bridge any shortfall in operational funding; and
- Communication and marketing considerations including SAHMRI badging of University researchers under the broad SAHMRI umbrella impacts the University's profile, with SAHMRI often promoted as the premier health research provider in South Australia, at the expense of the University's reputation.

There were also many direct benefits identified, including:

- Access to new, high quality space and infrastructure - SAHMRI offered the potential for a significant positive injection of funding and infrastructure into the health and medical research capability of SA;

- SAHMRI continues to provide an attractive destination for new talent; and
- The development of a new health-based biomedical research precinct was ultimately confirmed with the move of the Royal Adelaide Hospital to the site.

Interestingly, the earlier Cutler Report had noted that significant fragmentation had developed between medical research institutes and universities in Australia. Cutler concluded that “Australia’s position could be strengthened internationally by providing strong incentives and implementing mechanisms that would remove this fragmentation by encouraging the streamlining of smaller independent medical research institutes through strategic collaboration, or through amalgamation of some institutes, with universities.”

The funding model of SAHMRI was ultimately dependent on the three SA universities with the aim of maximising Commonwealth research funding and to enhance the international competitive position of the three universities. After a ramping phase, the expectation of a decade ago was that SAHMRI would reach its research income target of \$64M in 2020 with 70% of this derived from the NHMRC. As an MRI unencumbered by teaching loads and the demands of health service provision, the expectations of research performance for the new MRI were appropriately high.

SAHMRI was established on the basis that research grants and other sources of research income be administered through formally affiliated universities, rather than being handled in-house by the new Institute. This principle was agreed on the understanding that such an arrangement would efficiently deliver research management services without compromising the independence of SAHMRI. Resolution of this issue formed the basis of the subsequent Partnership and Research Support Agreements between the University and SAHMRI.

The Support Funding Agreements require the University of Adelaide to provide significant support funding directly to SAHMRI proportional to the number of grants. The University does not itself apply a direct service charge for managing grant activity.

On 17 July 2012, SAHMRI and the University of Adelaide entered into a new strategic partnership agreement. This agreement recognises that SAHMRI and the University want to collaborate in the delivery of the University’s teaching and each Party’s research activities, for their mutual benefit and that of their employees, the University’s students and the broader community. Through this agreement, the University accepted SAHMRI as an Affiliated Organisation, and SAHMRI has accepted the University as a core Strategic Partner.

In 2011, the Strategic Review of Health and Medical Research (McKeon Review) was undertaken to seek a better vision for better health through research. The final report, released in April 2013, made a total of 21 recommendations aimed at significant reform of the HMR sector in Australia.

Noting that MRIs in Australia are heavily reliant on State and Federal Government funding to undertake research, a further review was commissioned by the Hon Peter Dutton in 2015 to assess, among other things, the ability of MRIs to win competitive grants and attract income from diversified sources.

Some relevant findings of these earlier reviews included:

- The reduction in the total number of grants allocated is contributing to the growing financial pressures being felt by some iMRIs, and particularly those more heavily reliant on government funding for their viability;
- The majority of the ongoing funding within the MRI sector over the past few years has been sourced from the competitive grants funded by the Commonwealth Government and to a lesser extent from State Governments. It is apparent that those iMRIs with the stronger financial results showed a tendency towards a more diversified income base;
- The greater the economies of scale, the greater the funds available to fund direct research expenditure. Administrative costs associated with the running of an iMRI are proportionately higher for smaller institutions that do not have the economies of scale; and
- Differences in levels of indirect support available to the range of stakeholders, for example universities, iMRIs and health services, have created an environment that is considered to be more competitive than collaborative.

The 2015 Review also concluded that a relationship between iMRIs and third parties should include factors such as the extent to which:

- Strategic research directions are jointly determined, and day-to-day research activities are conducted and controlled through joint governance arrangements or committee structures;
- Research facilities, equipment and resources are jointly accessible and shared;
- Lead researcher employment and academic appointments (paid and unpaid) are jointly determined;
- Research training is conducted jointly;
- iMRI employees are provided with teaching opportunities;
- Ethical responsibility frameworks are jointly determined and managed;
- Academic outputs and outcomes are jointly recognised; and
- Back-of-office functions are shared.

This would seem to indicate that collaborative links in the South Australian health sector are yet to reach full maturity. For example, University staff who are SAHMRI affiliates and located in the SAHMRI building do not have the same access to facilities compared to those University staff who are “members” of SAHMRI. IP policies and arrangements also vary significantly across the institutions.

Advanced Health Research Translation Centres (AHRTCs) are a relatively recent NHMRC initiative, designed to recognise and encourage leadership in research translation. AHRTCs are also positioned as highly collaborative, with centres needing to demonstrate clear excellence across the areas of research, translation, health care and training. Centres are expected to share a vision, strategy, and clarity of purpose. On 28 March 2015, the NHMRC announced that the four successful Advanced Health Research and Translation Centres included the South Australian Advanced Health Research and Translation Centre. Their work is focused on three areas:

- Funding a range of priority translation projects including state-based Flagship Programs, Rapid Impact Projects and National Collaborative Projects;
- Building capacity amongst academics, researchers, clinicians and policy makers to enable and drive research translation; and
- Influencing and re-orientating systems to ensure there is the infrastructure in place to accelerate research findings into action.

From the University perspective, the aims remain relevant and commendable but the achievements and benefits of the Centre to date are not yet clear.

In 2018, Mr Jim Birch was engaged as an experienced independent consultant to undertake a research governance review encompassing all of SA Health examining current approaches and future requirements for research governance and more specifically ethics and SSA approvals. The Review was in response to a moderate to high level of dissatisfaction with the current state of affairs in respect to research governance, including ethics approval processes, SSA approval processes and the management of research grant finances. The Review concluded that notwithstanding the relative inefficiency and variability of approach in research governance, applications for ethics approval are professionally considered by various committees and no obvious shortcomings in respect to ethical considerations were identified. Nonetheless, it was made clear that the processes leading to approvals could be improved considerably.

In 2018, SAHMRI, the University of Adelaide, the University of South Australia and the Central Adelaide Local Health Network (CALHN) also formalised their partnership with the signing of the Adelaide BioMed City Collaboration Agreement. Adelaide BioMed City is a hub for health and life sciences. It co-locates institutions from research, education and clinical care in a precinct in the heart of Adelaide. Its mission is to be a globally recognised partnership leading in research, education, clinical care and population health. Located at the western end of North Terrace, it is one of the largest health science clusters in the southern hemisphere.

In 2020, the University of Adelaide undertook its own external review of Health and Medical Research, which noted that the relationship with SAHMRI continues to be overly complex. SAHMRI has established a number of themes which reflect a mirroring of the University of Adelaide’s strengths, themes and sometimes Research Institutes, often using the University’s own staff, and the Review recognised the challenge this presents and the need for both parties to work harder on a more nuanced approach. There are future conversations that need to be held with SAHMRI around

themes, attribution, branding etc., but these should not become significant impediments to future collaboration where this optimises synergies.

Planning is now underway for a companion building, SAHMRI 2, to bring together leading researchers from around the globe with ground-breaking technology to shape the future of health care practice. In particular, the proton therapy unit – a significant advancement in radiation for cancer – will be available in this ultra-modern building, for use in clinical trials and other research, in collaboration with other high-performance global research organisations. This will further add to the complexity of governance arrangements in the west-end precinct.

SAHMRI should fit in as a piece of the State Government's medical research investment but care should be taken to ensure it is integrated effectively with other elements of the South Australian health and medical sciences ecosystem which includes all the Local Health Services, SA Pathology and the three SA universities. Of course, each component of that ecosystem needs to have a sustainable business model. Such integration, if done successfully, could lead to a higher level of focus on research priorities and the integration of support services.

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